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tain facts relating to a group of objects, known as plants and animals, as distinguished from other facts relating to non-living objects, or from still other facts concerning human activities in methods of expression or of living. The path of each student in his approach to this goal is his own, and it varies in infinite degrees from all others—no beaten track of conformity to text assures his arrival.

"But hold!" says the efficiency expert of the curriculum makers, "Will the student learn all about plants and animals in *the* course in biology, will he be able to identify and name those forms he comes in contact with, will he know about the nature of his own body and of his relation to other animals? We want the student thoroughly grounded in the principles of biology, so make a book and teach him these things. For this purpose you may have him for one twenty-fifth of his college course." And so there is much writing of books and the puzzled teacher tries first one and then the other. Something is the matter with each one, so finally he makes a book of his own. If he has decided that the efficiency expert of the curriculum makers is right and that a certain group of facts, presented to the students for their acceptance or rejection is the proper content of a course he emerges from his trials very comfortably and, educationally, lives happily ever after.

Of the numerous efforts to supply the demand for text-books which shall inform students regarding the principles of biology, that of Calkins is one of the most satisfactory. Doubtless, in his own laboratory, the book occupies a proper place in relation to the individual work of the student; but it probably would not be far from the truth to assume that, even under these favorable conditions, the element of individual effort is small. In the hands of the dependent teacher even this remnant would disappear. When a descriptive text is used it results, under the best conditions of laboratory work, in confirmation by the student of facts studied in the book; in the absence of proper laboratory opportunities the course based upon it becomes merely another informational subject and the test of its accomplishment purely one of memory.

The distinction between the observational sciences and languages, history and other subjects presented on the basis of authority, largely disappears in the former alternative and entirely so in the latter. Undoubtedly the subject-matter of biology would well warrant its inclusion in a college course, but in the face of the opportunities for training students in making accurate observations, forming independent judgments and developing logical habits of thought—qualities that are always so much needed—how poor is the return! It is not to be denied that it is easier to inform students than it is to train them; it is not to be denied that there is a large popular demand that schools should instruct their students upon matters which will be of immediate "practical" use to them later. But it is the duty of schools to recognize that real education is training, and so to devise and administer their curricula as to provide this training, to the best advantage, for the various types of mind that are to be educated. In furthering this purpose the subject of biology offers unique and valuable opportunities to develop the powers of observation, comparison and judgment through personal experience with the scientific method. In view of the great significance of this method in our past achievements, and of its promise for the future betterment of society, it is incumbent upon teachers of those subjects, in which it is best emphasized, to insist that they be given time and opportunity to teach in ways calculated to render effective, to the largest degree, its operation in the activities of their students.

C. E. McCLUNG

*An Introduction to the Study of Fossils (Plants and Animals).* By HERVEY WOODBURN SHIMER. New York, The Macmillan Co. 1914.

In most sciences it is a remarkable year which does not produce at least one text-book, but paleontology has been taught in this country for eighty years before the appearance of this, the first strictly American elementary text-book of paleontology. Amos Eaton seems to have been the first American teacher to

present this subject to students, and, as a teacher, is only the grandfather or great-grandfather of the present generation, for James Hall was his pupil, and it is well known how many owe their training directly or indirectly to him. It is probable that few of the American paleontologists, excepting those who have graduated since 1900, received any formal instruction in paleontology, the general method being to set before the pupil a tray of fossils and the "Paleontology of New York," and await the, sometimes tardy, results of self-development. This meant, of course, a very long period of training, and the consequent discouragement of many who might otherwise have pursued the subject. This somewhat haphazard method was due, I believe, largely to the absence of any suitable text-book. These remarks do not, of course, refer to the vertebrate paleontologists who have in the main been zoologists, and who trace a very different and by no means parallel line of descent.

English text-books have been available and used to some extent. First Nicholson (1872, then at Toronto), later Nicholson and Lydecker (1889) were used, but these books were too compendious for introductory work, and have now long been out of date. Next came Wood's excellent little book (1893), now in its fourth edition, but this text covered only invertebrate paleontology and is much better adapted for the use of students in England than those in America. Finally came the English revision of Zittel's text-book (1900, 2d ed., 1913), which, though really a reference book, has been the background of the modern teaching of the subject in America. This book, valuable as it is, can not be placed in the hands of beginners, and all teachers will welcome the appearance of the present volume, a book which has been definitely planned to meet the needs of the novice, and which covers, in an elementary way, all branches of the subject.

The introduction of 28 pages is devoted largely to an excellent discussion of fossils and states of preservation. Personally, the reviewer regrets the appearance of the words fossilization and fossilized in this chapter. While these terms may be logically defined, they are seldom logically used, and, once set

before a student, no amount of warning will prevent his use of them in a sense implying some alteration of the original substance.

Pages 29 to 82 contain a brief presentation of some of the more important facts concerning fossil plants. It would manifestly be impossible to write, in 55 pages, an introduction to the study of paleobotany, but the author has made a wise choice of the points of more general interest and includes as much as it is possible to use in an ordinary introductory course in paleontology.

The Invertebrata occupy pages 83 to 320. In this part of the book the author follows uniformly the plan of presenting first a somewhat complete description of a typical, if possible, modern, example of each important group, describing the morphology, physiology, and to some extent the habits of the particular animal discussed. Thus, under the protozoa, *Amœba proteus* is described as a type of the phylum, while at the other end of the section, in the phylum Arthropoda, *Cambarus* is described as a type of the class Crustacea, and *Triarthrus* as a type of the subclass Trilobita. Following the description of the type comes a general discussion of the group, relating particularly to those members found as fossils, and finally a brief description of some of the more important genera. Some paleontologists will doubtless criticize the amount of space devoted to the morphology and particularly the physiology of modern forms, but those of us who have to teach know that students rarely come to us with the kind of zoological training which would best fit them to take up paleontology, and to have in one book the zoology and paleontology will be of the utmost use to us.

Pages 321 to 402 contain the description of the Chordata, the cat being taken as a type of the Vertebrata. This part of the book is necessarily, from its briefness, somewhat less technical than the preceding part, but gives a good résumé of the important structural features of the various groups of vertebrates, and of the phylogenies of several families. It is usually found that this part of the subject is of much greater interest to the student and general public than any other part, and it is

to be regretted that the limits of the book did not allow a somewhat more expanded treatment, especially of the Reptilia and Primates.

On pages 403 to 406 one finds a brief bibliography of some of the more important books on subjects treated in the volume, and then follow three pages giving in tabular form the geological time scale and the geological ranges of the principal classes of plants and animals. The remaining 39 pages are devoted to an unusually full index and glossary.

The illustrations in the book deserve special mention. They are very numerous, and an unusually large number are original or redrawn for this work, and all are remarkably clear, well executed, and well reproduced. The figures of the echinoid, pages 167 and 168, may be particularly noted for their delicacy and clearness. Altogether the illustrations are better than those usually found in an elementary text-book.

A very useful feature is the practise throughout the book of giving the derivation of the generic and other group names. The questions, designed to direct laboratory work in connection with the text, will be of more or less value, according to the individual teacher. They serve as a review for the reader and draw attention to the important points in the descriptions. The book is of convenient size, the type good, and though certain paragraphs and the questions are set in another font from the main part of the text, the differences are not so great as to mar the appearance of the page, and are by no means comparable to the "fine print" of a generation ago.

As a text for an introductory course in paleontology the book strikes one as especially well balanced and well done. It will also be found extremely useful to the students of zoology and historical geology, and furnishes us with an answer to the question put so often to a geologist or paleontologist: "Where can I find a book about fossils which I can read without first studying paleontology?"

This review is not meant either as a eulogy or as a criticism of the book in hand, but the writer is aware that the text does contain some small slips, of the kind so peculiarly annoying to the author, but so difficult to detect in proof-

reading. Most of these are small things which are either so obvious as to be without danger to the student, or things which would be apparent only to the specialist, and may easily be corrected in a later edition. One which might perplex the beginner is on page 352, where the Urodela are called Lizards. The others are almost all in the explanations of the figures.

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### SPECIAL ARTICLES

#### ON THE LIFE OF ANIMALS WITH SUPPRESSED KIDNEY FUNCTION

BOTH clinical and laboratory observations agree in demonstrating that many of the so-called consequences of kidney disease are really nothing of the kind, but must be interpreted in some other fashion. Thus, the assumption that the edema sometimes found in patients suffering from kidney disease is the consequence of the disturbed kidney function lacks all support, for patients with complete suppression, or animals from which both kidneys are removed, do not show any consequent edema. In fact, such patients and animals steadily lose in weight unless special efforts are made to keep this up. Large, nephrectomized rabbits, for example, will lose some 50 grams per day before they succumb some four to eight days later.

In the same way that clinical experience and experiment have shown that the edema accompanying certain kidney disturbances is not to be regarded as a consequence of the loss of kidney function, they prove also that high blood pressure, cardiac hypertrophy, and the clinical manifestations of headache, stupor, coma, etc., so commonly regarded as "uremic" are not secondary to such loss of kidney function as so widely believed. The fact remains, however, that even though much revision is necessary in our interpretation of the signs and symptoms evidenced by victims of kidney disease, loss of kidney function is commonly regarded as incompatible with any prolonged continuance of life.

Why does man or an animal deprived of his